Scaling laws & dimensional analysis in Soft Matter
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Abstract:

Mechanics provides an ancient but robust framework to relate motion to its "reasons", to the "forces" at play. The classical way to represent this connection was proposed by Newton: F=ma, or a=F/m. A metric of motion--the acceleration--is expressed from a ratio of mechanical quantities: the force F, impelling motion, and the mass m, impeding it. More than three centuries have passed and the painstaking recording of natural phenomena has progressively enlarged this mechanical paradigm. Now, the impelling and impeding factors are not solely understood as forces and masses, but invoke an array of mechanical quantities: density, momentum, energy, action, power, stiffness, pressure, viscosity, etc. Dimensional analysis provides a unifying framework to understand how these generalizations of the mass and force conspire to produce motion. Being often at the frontier of what is known, soft materials offer a great opportunity to explore new connections between mechanics and kinematics.